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EXAMINER

CARTER, MICHAEL W

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/594,422	Applicant(s) KITANO ET AL.	
	Examiner MICHAEL CARTER	Art Unit 2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period **will** apply and **will** expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply **will**, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 June 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 11-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. **Claims 1-4, 6-9, 14-19, and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over US PG Pub 2004/0124500 (Kawagoe) in view of JP Patent 5-190980 (Norihiro) and further in view of US Patent 5,138,626 (Yap).
3. **For claims 1-4**, Kawagoe teaches, a nitride semiconductor laser element comprising: a semiconductor stacked structure including a semiconductor layer of a first conductivity type (figure 1, labels 103-106), an active layer (figure 1, label 107) and a semiconductor layer of a second conductivity type (figure 1, labels 188-111), which are stacked one upon the other and each comprises a nitride (paragraph 28); a striped waveguide region for a laser light provided on the semiconductor layer of the second conductivity type (figure 1, label 111).
4. Kawagoe does not teach an insulative region, formed by implanting ions, for reducing the capacitance of the element, wherein a pn-junction of the semiconductor layer at a peripheral region remote from the waveguide region is broken the insulative region being present remote from at least a portion of an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region.
5. However, Norihiro teaches an insulative region (figure 1, label 8), formed by implanting ions, for reducing the capacitance of the element, wherein a pn-junction of

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the semiconductor layer at a peripheral region remote from the waveguide region is broken (figure 1 and paragraphs 5-6).

6. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine the insulating region taught by Norihiro with Kawagoe's laser in order to increase the speed of the laser.

7. The combination does not teach the insulative region only being formed remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region.

8. However, Yap does teach the insulative region only being formed remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region (figure 5c implant region 54 and 56 do not extend to the right edge of the device) in order to place electrode 64 on the top surface of the laser (column 7, lines 51-57).

9. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the insulative region only remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region as taught by Yap in order to place the lower electrode on the top surface of the laser of the previous combination.

10. **For claim 4**, Kawagoe, Norihiro and Yap are applied as to claims 1-3. Further, Kawagoe teaches a substrate (figure 1, label 101), an embedded insulation film covering a side face of the waveguide region and a surface of the semiconductor layer of the second conductivity type (figure 1, label 162), a first electrode in contact with a

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surface of the waveguide region (figure 1, label 120), a protective insulation film covering at least a part of the embedded insulation film (figure 1, label 164), a second electrode substantially connected to the semiconductor layer of the first conductivity type (figure 1, label 121).

11. **For claim 6**, the combination does not teach the insulative region for reducing the capacitance of the element has a peak of distribution of the impurity concentration in the depth direction in the range from 200 nm to 1 μ m from the surface of the semiconductor layer of the second conductivity type.

12. However, it has been held that discovering a workable range involves only routine skill in the art. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to discover the workable range for the depth of implantation in order to form the insulative region as discussed for claim 1.

13. **For claim 7**, the combination teaches the first electrode is formed in contact with the surface of the waveguide region so as to cover a part of the embedded insulation film (figure 1), a pad electrode is formed in contact with the first electrode so as to cover a part of the protective insulation film (figure 1, label 122), and the insulative region for reducing the capacitance of the element includes a region below the embedded insulation film (figure1 of both Kawage and Norihiro).

14. **For claim 8**, the combination is applied as to claim 7. Further, the combination teaches the insulation region for reducing the capacitance of the element includes at least the first electrode or a region below the pad electrode (figure1 of both Kawage and Norihiro). The combination further teaches the first electrode (Kawagoe, figure 1, label

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120 and Norihiro, figure 1, label 9) is formed in contact with the surface of the waveguide region (Kawagoe, figure 1, label 111) so as to cover a part of the embedded insulation pad (Kawagoe, figure 1, label 162) a pad electrode is formed in contact with the first electrode so as to cover a part of the protective insulation film (figure 1, label 122) and the insulative region for reducing the capacitance of the element includes a region below the first electrode or the pad electrode embedded insulation film (figure 1 of both Kawagoe and Norihiro).

15. **For claim 9**, Kawagoe teaches the semiconductor laser element is a laser element for emitting bluish-purple light (paragraphs 2 and 5).

16. The combination does not teach the responsiveness of the laser to input of pulse drive current. However, as discussed for claim 1, the combination does teach speeding up a laser. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to set the responsiveness according to the speed required by an application using the laser, and no special significance is given to a response time of 1 ns.

17. **Claim 14** is rejected according to the rejection of claims 1 and 9 above

18. **For claim 15**, the art is applied according to the rejection of claim 8.

19. **For claim 16**, Norihiro further teaches the insulative region for reducing the capacitance of the element is present remote from a resonance surface of the semiconductor laser. Paragraph [0006], 2) states that O^+ ions are injected using the SiO_2 stripe as a mask. The mask covers the center portion of the laser and O^+ is therefore deposited down the sides of the mask. Portions of the deposition are remote

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from the resonance surface.

20. For claim 17-19 and 21, the prior art does not explicitly teach the semiconductor stacked structure is rectangular when viewed in plan. However, it is a standard design to form a ridge waveguide laser with a rectangular structure when viewed in plan. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a rectangular structure to form an edge emitting device. See for example Nagashima et al. US Patent 6,697,407 (hereinafter referred to as Nagashima) figure 4c. While Nagashima does not show the full structure in plan, it would have been obvious to one of ordinary skill in the art that there is a matching back surface which forms the laser cavity.

21. Claim 5 remains rejected under 35 U.S.C. 103(a) as being unpatentable over Kawagoe, in view of Norihiro and Yap, and further in view of US PG Pub 2001/0006529 (Komori).

22. For claim 5, Kawagoe, Norihiro and Yap remain applied as to claim 1.

23. The combination does not teach the insulative region for reducing the capacitance of the element has an impurity peak concentration in the range from 1×10^{18} to 5×10^{21} atoms/cm³.

24. However, Komori does teach using a concentration 3×10^{18} atoms/cm³ in order to create a current blocking layer (paragraph 41).

25. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to determine the workable range, including 3×10^{18} atoms/cm³, for impurity concentration in order create a current blocking layer, as discussed for claim 1,

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since it has been held that discovering a workable range only involves routine skill in the art.

26. **Claims 11-13 and 20** remain rejected under 35 U.S.C. 103(a) as being unpatentable over Kawagoe in view of Yap and further in view of US Patent 6,697,407 (Nagashima).

27. **For claim 11**, Kawagoe teaches a nitride semiconductor laser element characterized by comprising: a semiconductor layer of a first conductivity type (figure 1, labels 103-106), an active layer (figure 1, label 107) and a semiconductor layer of a second conductivity type being different from the first conductivity type (figure 1, labels 188-111), which are stacked on a main surface of a substrate and each comprises a nitride (paragraph 28); and a striped waveguide region for a laser light provided on the semiconductor layer of the second conductivity type (figure 1, label 111).

28. Kawagoe does not teach wherein at least a part of the semiconductor layer of the second conductivity type serves as a region for reducing the capacitance of the element by being converted into the first conductivity type in a direction of thickness at a peripheral region remote from at least a portion of an external edge remote from the waveguide region.

29. However, Nagashima does teach at least a part of the semiconductor layer of the second conductivity type serves as a region for reducing the capacitance of the element by being converted into the first conductivity type in a direction of thickness at a peripheral region remote from the waveguide region (figure 1, label 30) in order to form a current blocking layer (column 10, lines 33-38). Nagashima further teaches the region

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of the second conductivity type (figure 1, label 26) between the regions of the first conductivity type (figure 1, labels 30) shows the region for reducing capacitance is remote from at least a portion of an external edge remote from the waveguide region.

30. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to convert part of the second type layer in Kawagoe into a first type layer according to Nagashima in order to form a current blocking layer.

31. The combination does not teach the region for reducing capacitance of the element only being formed remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region.

32. However, Yap does teach region for reducing capacitance of the element only being formed remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region (figure 5c implant region 54 and 56 do not extend to the right edge of the device) in order to place electrode 64 on the top surface of the laser (column 7, lines 51-57).

33. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the region for reducing capacitance of the element only remote from an external edge of the semiconductor stacked structure when viewed in plan, said external edge being remote from the striped waveguide region as taught by Yap in order to place the lower electrode on the top surface of the laser of the previous combination.

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34. **For claim 12**, Nagashima further teaches an npn structure (figure 1, labels 21, 29, and 30) in the peripheral region remote from the waveguide region, wherein the semiconductor layer of the first conductivity type is an n-type semiconductor layer, and the semiconductor layer of the second conductivity type is a p-type semiconductor layer.

35. **For claim 13**, Nagashima further teaches a pnpn structure (figure 1, labels 21, 29, 30, and 31) in the peripheral region remote from the waveguide region, wherein the semiconductor layer of the first conductivity type is an n-type semiconductor layer, and the semiconductor layer of the second conductivity type is a p-type semiconductor layer.

36. **For claim 20**, the prior art does not explicitly teach the semiconductor stacked structure is rectangular when viewed in plan. However, it is a standard design to form a ridge waveguide laser with a rectangular structure when viewed in plan. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a rectangular structure to form an edge emitting device. See for example Nagashima et al. US Patent 6,697,407 (hereinafter referred to as Nagashima) figure 4c. While Nagashima does not show the full structure in plan, it would have been obvious to one of ordinary skill in the art that there is a matching back surface which forms the laser cavity.

Response to Arguments

37. Applicant's arguments with respect to claims 1-9 and 11-21 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

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38. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

39. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

40. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL CARTER whose telephone number is (571)270-1872. The examiner can normally be reached on Monday-Friday, 7:00 a.m.-4:30 p.m., EST.

41. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571) 272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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42. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MC/

/Minsun Harvey/

Supervisory Patent Examiner, Art Unit 2828